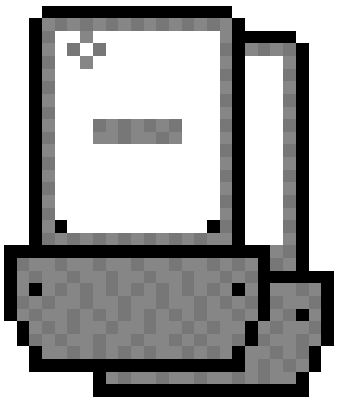

Multitariff Combi Meter
EPQM

User Manual
Version 1.1

"ELGAMA ELEKTRONIKA" Ltd.
Vilnius, Lithuania

Multitariff Combi Meter
EPQM

User Manual

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“ELGAMA-ELEKTRONIKA” Ltd.

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Caution: Warranty shall not apply to any meter, which has been subject to incorrect installation, or neither use not in accordance with instructions, therefore read this EPQM meter manual carefully and be sure you are well familiarized with this information before you start perform any action (installation, parameterization etc.) with meter.

1. Purpose and features

The EPQM meter is a modern multi-tariff electricity meter capable of measuring active and reactive electrical energy of both directions. The meter is designed for industry and can be used in automatic billing systems or power marketing systems.

EPQM meter has the following features:

- Tariff module enabling of creating flexible tariff management programs;
- Display of the following values: instantaneous voltage and current of each phase; active, reactive, and apparent power, frequency, and cos φ; transmission of these values via communication interfaces;
- Measurement of demand profile and maximum demand of day and month;
- Data are called out on the display by affecting handling photo sensor with the light pulses, thus ensuring long-term leak proof of the meter and reliability of the controls;
- Abbreviated parameter label and index shown together with its value;
- Two independent communication interfaces for remote data transmission;
- All accumulated data can be reviewed on the display or sent via communication interfaces even network power supply is disconnected.

There are EPQM meter modifications for 3- or 4-wire networks (CT connection only).
The measurement accuracy complies with the IEC 62053-22 Standard requirements (Class 0.5s) for active energy measurement and IEC 62053-21 Standard requirements (Class 1.0) for reactive energy measurement (substituting cosφ with sinφ).

2. Design

2.1. Meter Case

The meter panel is covered by transparent cover, molded from UV ray-stabilized polycarbonate, performing several functions:

- Protection against external mechanical factors;
- Protection against pressing initialization button.

The cover is fixed to the case by two sealed screws.

Meter panel is located under the cover. The panel holds all meter information required by the international IEC 62053-21 Standard.

Liquid crystal display (LCD) is located on the frontal part of the meter. It allows displaying all values stored in the memory, instantaneous values and parameters.

Handling photo sensor (HPS) is located on the lower left. In order to display specific information on LCD, HPS must be affected with light signal of specified duration.

D0 optical interface is located on the right side of the frontal part. It is used for local data uploading to the PC and meter parameterization.

There is one more photo sensor on the right of the optical interface for the deactivation of communication block system (for communication acc. IEC 62056-21 only. See paragraph 9.2.2.). This feature is optional. Base model doesn't includes it.

Backup power supply (Standard 3,6 V Lithium battery) is included in the meter for powering internal clock in case of main electrical network failure. If message *-Bad Battery-* appears on the display, the battery must be replaced.

Only the manufacturer or its authorized representative may replace the battery!

The power and auxiliary terminal block is located on the bottom of the meter. All connections having been completed and checked, the terminal block shall be covered with sealed cover.

2.2. Electronic circuits and operation principles

The meter block diagram is shown in Figure 2-1.

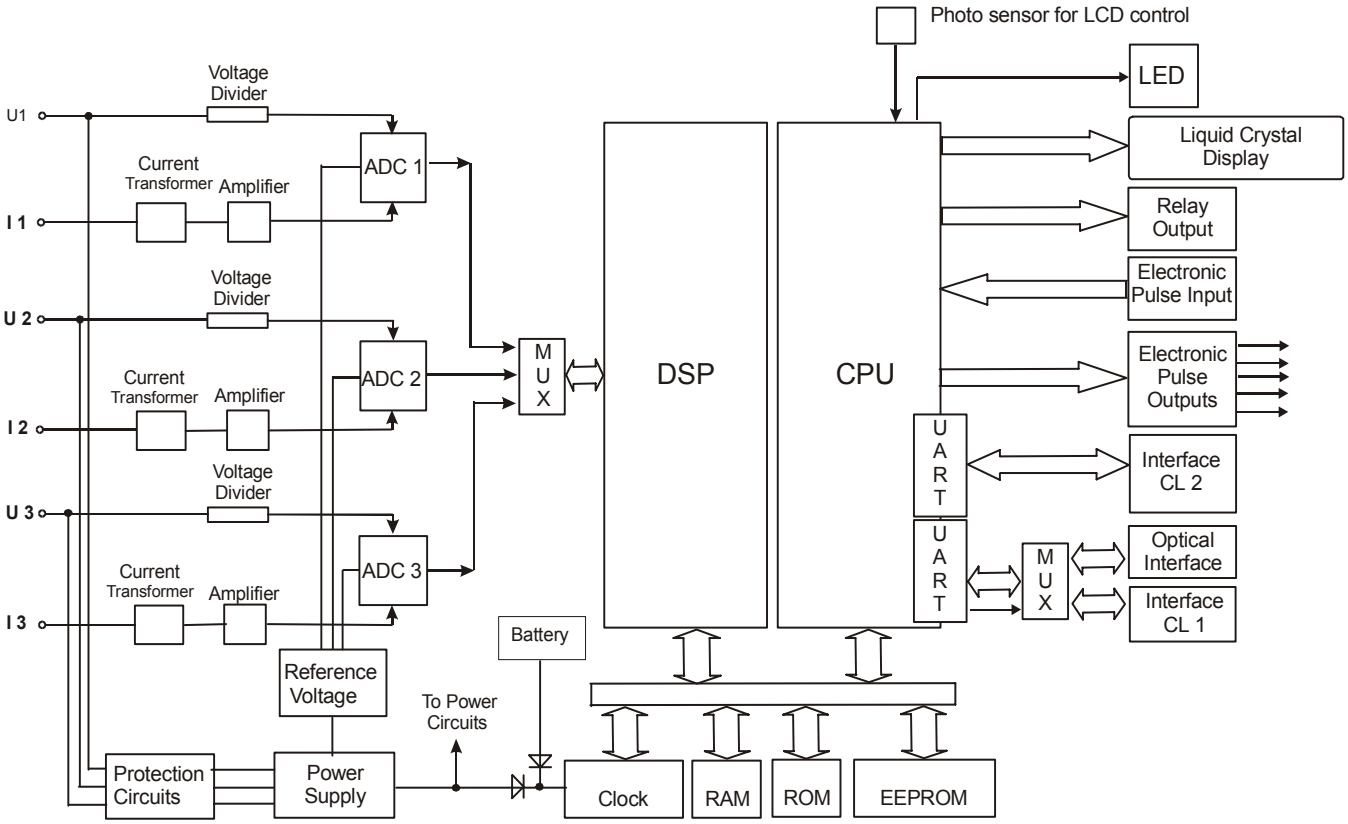


Figure 2-1. Meter block diagram.

2.2.1. Measurement module

The measurement module converts the electric network voltage and current values to corresponding analogue signals by voltage dividers and current transformers. The current signals are amplified to a necessary level by an amplifier.

2.2.2. Analogue Signal Conversion

From the measurement module, analogue voltage and current signals further go to a Sigma – Delta integrator which converts the analogue signals into digital 16-bit codes about 400 times during a single AC period. Thus each converter forms 19200 digital 32-bit codes per second. There 16 bits hold for current value description and 16 –voltage value description in each code

Codes of each phase generated by the analogue-digital converters are received by a multiplexer unit (MUX), which combines them into a single code sequence. The set (output code) contains information about each phase voltage and current values. Their order within the sequence is shown in the Table 1.

Table 1

Phase L1		Phase L2		Phase L3	
U_1 code	I_1 code	U_2 code	I_2 code	U_3 code	I_3 code

2.2.3. Digital Signal Processor

MUX output code sequence is further processed by the digital signal processor unit (DSP). During the factory parameterization, DSP calibration constants such as power transmission factor of each phase, sensitivity threshold, and pulse output constants are entered. The codes undergo mathematical processing with those constants applied. The processor then calculates square voltage, square current and active and reactive power values for each phase: $\mathbf{I^2_A}$, $\mathbf{I^2_B}$, $\mathbf{I^2_C}$, $\mathbf{U^2_A}$, $\mathbf{U^2_B}$, $\mathbf{U^2_C}$, $\mathbf{P_A}$, $\mathbf{P_B}$, $\mathbf{P_C}$ and $\mathbf{q_A}$, $\mathbf{q_B}$, $\mathbf{q_C}$.

2.2.4. Central Processor Unit

The calculated data are transmitted from DSP unit to RAM unit at a frequency of network period. The central processor unit (CPU) reads the data and carries out the final calculation of power, energy and effect values. CPU also acts as a controller of memory units, LCD, and communication interfaces, generates LED signals and performs other functions.

2.2.5. EEPROM Unit

All meter data and parameters are stored in EEPROM unit with exception of instantaneous values. The electrically erasable programmable read-only memory unit does not require any power supply for data storage. The data are written to the memory at the end of each integration period and in case of power failure.

2.2.6. Internal clock

The meter has a built-in independent real-time clock that counts real time (hours, minutes, seconds), date (year, day, week day), generates control signals corresponding to 4 tariff time zones (**T1 … T4**). In case of power supply failure, the clock is powered by Lithium battery. In case network power is of, the clock preserves tariff time zone control function for 12 months and counts time at least 10 years. If the meter is supplied on the expiration of that period, it operates in single-tariff mode and data are assigned to **T1** tariff zone.

The clock has automatic leap-year and daylight savings time adjustment. The dates and times (format MM-DD hh:mm) of changes are entered during meter parameterization.

There are three possible options of daylight saving changes:

- If both time values are equal to 00-00 00:00, no adjustment is made;
- If time format MM-00 00:00 is entered, the adjustment to winter time is made automatically on the last Sunday of the month specified during the parameterization (from 2 AM to 3 AM); the adjustment to summer time is made automatically on the last Sunday of the month specified during the parameterization (from 3 AM to 2 AM);
- If time format MM-DD hh:mm is entered, the adjustment is made on the specified day of month at the specified time;

Note: *both date and time formats for adjustment to winter-summer time and summer-winter time must match.*

2.2.7. Liquid crystal display (LCD)

The meter has an alphanumerical 32-symbol two-line LCD for data output. The manual data scrolling to the display is initiated by affecting HPS with long (>2 sec) and short (<0.5 sec) light pulses.

LCD with backup lightning are available upon a special request.

2.3. Communication Interfaces

EPQM meter has standard optical and current loop interfaces for data exchange with external units.

2.3.1. Optical Interface (D0)

This interface is used for stored data downloading to the local PC (LZPEMS software is required) or Hand Held Unit and for meter parameterization. The optical interface communication protocol complies with IEC 62056-21 Standard. The maximum baud rate is 9600 bps. For more information on data transferring via this interface see chapter 7, "Communication".

2.3.2. Current Loop Interface (CL1)

This interface is used for data downloading to remote PC via local network and remote meter parameterization. The current loop interface complies with IEC 62056-31 or IEC 62056-21 communication protocol. If baud rate via current loop interface is specified during meter parameterization, IEC 62056-31 protocol is used; in other cases IEC 62056-21 protocol is used. The maximum baud rate (using IEC 62056-31 protocol) is 19200 bps. For more information on data transferring via this interface see chapter 7, "Communication".

Notes:

- *It is impossible to use both optical interface and current loop interface CL1 for data transfer; concurrently. The data are transferred via the interface first connected to. If a request arrives simultaneously to both interfaces the optical interface has higher priority;*
- *In order to organize communication via current loop in local network, special software for PC is required.*

2.3.3. Auxiliary Communication Interfaces (optional)

The following auxiliary communication interfaces can be built in upon request:

- Current loop interface (CL2) is used for instantaneous data transferring. It operates independently from other interfaces;
- Electric interface RS 485;
- M – BUS interface.

2.4. The Meter Inputs and outputs

2.4.1. Optical Test Output

The optical Test output (light emission diode) is located on the front panel, above the LCD. The LED emits light signals whose frequency corresponds with consumed active or reactive (specified during parameterization) electrical energy. LED signals are generated by the meter's CPU. This output is described in terms of a light signal duration and meter constant, those values are specified during factory parameterization. The LED constant means a number of light signals emitted for 1 kWh of consumed electrical energy.

Note: *LED should flash only while current flow is registered. If LED is flashing when there is no network load., i.e. no energy consumed, the meter must be repaired.*

2.4.2. Electronic Pulse Outputs

An electronic pulse output generates telemetry pulses for energy accounting systems. All outputs are galvanic insulated from the meter electronic circuits by the optrons.

Usually EPQM meter has 5 electronic pulse outputs: 4r of them generate pulses proportional to consumed active and reactive energy of both directions (+P, -P, +Q, -Q) while the 5th has electronic test outputs and duplicates LED signals. Each output has an output circuit consisting of n-p-n transistor with an open collector. All emitters of pulse output transistors are connected together. If there is no signal, transistor is closed (digital 0). When a signal is being transmitted, transistor opens (digital 1). The input parameters are the following:

Table 2

Parameter	Parameter value
Output circuit impedance when the transistor is closed	No less than 200kΩ
Output circuit impedance when the transistor is open	No more than 50Ω
Switching voltage	No more than 24V
Switching current	No more than 30mA
Pulse constant*, pulse/kWh, pulse/kvarh	From 1 to 65530
Pulse duration*, ms	From 10 to 250
Pause between pulses*, ms	From 10 to 250

*Those constants are specified during meter parameterization via optical interface.

Note: *the correspondence of the kind energy signals to specific outputs is specified in the meter datasheet.*

2.4.3. Digital Input (SO)

EPQM meter can register signals sent by an external device, no external voltage required. The data received via this input are stored in a separate register. They can be reviewed or transferred together with other meter data. The pulse input parameters are the following:

Table 3

Parameter	Parameter value
Open circuit output voltage	12V±20%
Short-circuited circuit current	15mA ±10%
Minimal amplitude of input current	No less than 10mA
Maximal residual input current	No more than 1mA
Pulse constant*, pulse/kWh, pulse/kvarh	From 1 to 65530
Constant exponent*	10^{-9} to 10^{0}
Pulse duration*, ms	From 10 to 250
Pause between pulses*, ms	From 10 to 250

* Those constants are specified during meter parameterization via optical interface.

2.4.4. Relay Output (MKI)

The relay output can be programmed so that relay can operate in any one of the 4 tariff time zones. The relay operation zone is specified during meter parameterization. The relay output parameters are the following:

Table 4

Parameter	Parameter value
Maximal voltage switching by the relay's contacts	No more than 250V
Switching current	No more than 2A
Switching power	No more than 30VA

2.4.5. Terminals for External Power Supply (optional)

External power supply (12 …18 V DC) can be connected to the meter. Such a backup supply is used for data reading in case of electrical network failure or after the meter is disconnected from the electrical network. No more than 200 mA current is used by the meter using such backup power supply. Once an external power supply is connected, the data stored in the meter can be displayed on LCD or transmitted via any communication interface. The external power supply connection diagram is provided in the meter datasheet. After the backup power supply is connected, a sign □ appears on the left side of second row of LCD instead of arrow.

Notes:

- *It is not mandatory to disconnect the backup power supply after the meter has been connected to the electrical network*
- *External backup power supply terminals can be included in the meter upon a separate request only!*

2.5. Power Supply

The components of the meter electronic circuits are powered by pulse power supply. It ensures smooth operation within the permissible voltage range from -20% to +15% of nominal network voltage. The power supply protects the meter from brief "lightning-type" voltage surges and is not associated with any single phase so the meter is operating as long as there is voltage at least in one phase.

A special circuit checks its voltage and if it drops below a certain critical value, CPU writes vital data on the meter state and measured values to EEPROM. After a voltage is on again, meter restores its state from the stored data, switches tariffs if necessary and carries out measurements further. Thus meter data are reliably protected against unexpected results of power failure.

2.6. Direct/Alternating External Magnetic Field Sensor

The meter checks magnetic environment with a built-in magnetic field sensor. If an additional direct or alternating external magnetic field capable of distorting the measurement results is detected, the meter records the duration of effect, the number of influences, and date and time of the last influence's end.

3. Measurements

EPQM meters multiplies voltage, current, energy, and power values by the rates of external voltage and current measurement transformers; these rates are specified during meter parameterization.
If an energy or power value shown on the display end with E1, E2, E3, etc. – it means that the value must be multiplied respectively by 10, 100, 1000, etc. I. e., the digit following the letter E is an exponent of 10. The value of this exponent is equal to a sum of specified exponents of transformations factors of voltage and current measurement transformers. The exponent value increases by 1 if all 8 display segments for data output are filled up.

Units of measured and calculated values are the following:

Power,	kW, kvar;
energy,	kWh, kvarh;
Voltage,	V;
Current,	A;
Frequency,	Hz.

3.1.Measurement Quantities

EPQM meter measures active and reactive electrical energy of both directions in four quadrant system. It can measure the following kinds of energy and power:

- Positive and negative active energy **+W, -W;**
- Positive reactive energy **+Q =Q1+Q2;**
- Negative reactive energy **-Q =Q3+Q4;**
- Positive and negative active power **+P, -P;**
- Positive reactive power **+q;**
- Negative reactive power **-q;**
- For each phase: instantaneous active, reactive, and total power and apparent power.

The meter can also display the following values for each phase: voltage, current, and power factor (cos φ).

For power quadrant determination, see Figure 3-1.

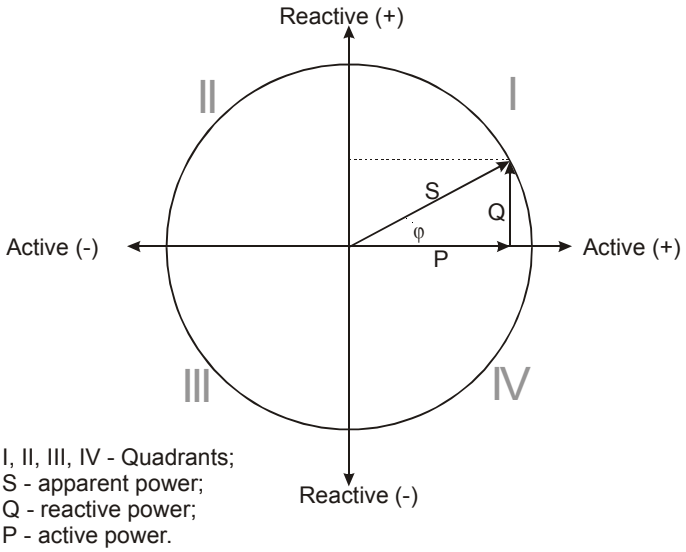


Figure 3-1. Quadrant determination for power measurement

3.2. Power Measurement

EPQM meter can measure instantaneous power; calculate average active and reactive power over the integration period; find the maximum active and reactive power demand over day or month.

3.2.1. Instantaneous Power Measurement

DSP calculates instantaneous power values according to instantaneous voltage and current values.

In this case instantaneous power is average power calculated over a second.

Instantaneous active and reactive power values for each phase are calculated by formulae 1 and 2:

$$P = \sum_{i=0}^{n} \frac{U_i \cdot I_i}{n} \qquad (1)$$

$$Q = \sum_{i=0}^{n} \frac{U_i^{90} \cdot I_i}{n} \qquad (2)$$

U_i - instantaneous phase voltage;

U_i^{90} - instantaneous phase voltage with phase shift of 90°;

I_i -instantaneous phase current;

n – number of voltage and current measurements in a second (n=19200).

The instantaneous apparent power S is calculated by the formula 3:

$$S = \sqrt{P^2 + Q^2} \qquad (3)$$

Total power of all phases P_Σ, Q_Σ is calculated by arithmetically adding power values of all phases:

$$P_\Sigma = P_A + P_B + P_C\,,\ Q_\Sigma = Q_A + Q_B + Q_C \qquad (4)$$

3.2.2. Demand

EPQM meter measures demand

Integration period – time period during which average values of powers are calculated.

Demand – average value of power throughout the integration period.

*On the meter display, the integration period for active energy is marked by - **P15, P30, P60**; the integration period for reactive energy is marked in the similar way - **Q15, Q30** and **Q60.***

Demand P(15, 30, 60) and Q(15, 30, 60) is calculated by the formula:

$$P = \frac{\Delta E \cdot 3600}{\Delta t} \ , \ Q = \frac{\Delta E \cdot 3600}{\Delta t} \qquad (5)$$

ΔE – energy consumed since the beginning of integration period [kWh or kVArh],

Δt – number of seconds passed since the beginning of integration period.

EPQM meter allows selecting one of three from the three integration period duration: 15, 30, or 60 minutes. The integration period has the following features:

- The integration period is synchronized with the beginning of the day;
- The change between tariff zones must be synchronized with the beginning of integration period;
- Demand is calculated over a fixed interval only.

Note: *the duration of integration period can be changed during parameterization only!*

Demand value is stored into EEPROM unit at the end of integration period. The number of integration periods stored in memory depends on the duration of integration period. The number of days, meters stores integration period value in EEPROM, depends on the duration of integration period (Table 5).

Table 5

Period duration, min	Number of days
15	35
30	70
60	140

3.2.3. Maximum demand

Maximum demand – the maximum power of integration period over a specified time interval (day or month).

The meter detects and stores the values of maximum demand over a day and month in a separate register. Maximum demand values of each tariff time zone for last 15 months (including the present month) are stored in maximum demand register of a month. Maximum demand values of each tariff time zone are stored in maximum demand register of a day. The duration of value storage in the respective registers is the same as for demand (see Table 5). There might be up to 8 maximum demand registers:

- Maximum demand register of a day 4 tariffs = 4 registers;
- Maximum demand register of a month x 4 tariffs = 4 registers.

3.3. Energy Measurement

EPQM meter calculates the following energy values:

- Active energy of both directions over 24-hour – total and for each tariff;
- Active energy of both directions over a month – total and by for each tariff;
- Reactive positive energy over 24-hour - total and for each tariff;
- Reactive positive energy over a month - total and for each tariff;
- Reactive negative energy over 24-hour - total and for each tariff;
- Reactive negative energy over a month - total and for each tariff;
- Energy consumption of the present and last month calculated by pulses from pulse input;

- Total energy for each tariff;
- Total energy for each tariff.

For the energy register description see Table 6.

The energy is calculated by integrating power as a time function:

$$A_i = \int_t P_i(t)dt \text{ - instantaneous value of active energy} \quad (6)$$

$$R_i = \int_t Q_i(t)dt \text{ - instantaneous value of reactive energy} \quad (7)$$

The values of active and reactive energy of both directions are calculated by adding up the instantaneous values.

3.4. Power Factor (Cos φ) Calculation

EPQM meter calculates and displays power factor (cos φ). Cos (φ) is calculated by the formula:

$$\cos\varphi = \frac{P}{S} = \frac{P}{\sqrt{P^2 + Q^2}}.$$

Cos (φ) value can be displayed on LCD only for three-phase load. LZPEMS and ENERSIS software calculate cos (φ) values for each phase according to data received via communication interfaces.

4. Tariffs

EPQM meter has a software tariff module which distributes active and reactive energy data to registers according to tariff time zones. This module calculates values of average power of integration period and registers maximum demand of day and month. It carries out schedules of day, week, and season. These schedules can control up to 4 energy and maximum demand tariffs.

4.1. Tariff Registers

Tariff module distributes calculated values according to tariff time zones and entered into appropriate registers. Up to 4 daytime intervals when the tariff is active can be set for each tariff time zone. Energy and power registers of the basic meter configuration are described in Table 6.

Table 6

Registers	Parameter name / number of values stored in register									
	T1		T2		T3		T4		TΣ	
Energy	$+W_{tot}$	1	$+W_{tot}$	1	$+W_{tot}$	1	$+W_{tot}$	1	$+W_{tot}$	1
	$-W_{tot}$	1	$-W_{tot}$	1	$-W_{tot}$	1	$-W_{tot}$	1	$-W_{tot}$	1
	$+Q_{tot}$	1	$+Q_{tot}$	1	$+Q_{tot}$	1	$+Q_{tot}$	1	$+Q_{tot}$	1
	$-Q_{tot}$	1	$-Q_{tot}$	1	$-Q_{tot}$	1	$-Q_{tot}$	1	$-Q_{tot}$	1
	$+W_{month}$	15	$+W_{month}$	15	$+W_{month}$	15	$+W_{month}$	15	$+W_{month}$	15
	$-W_{month}$	15	$-W_{month}$	15	$-W_{month}$	15	$-W_{month}$	15	$-W_{month}$	15
	$+Q_{month}$	15	$+Q_{month}$	15	$+Q_{month}$	15	$+Q_{month}$	15	$+Q_{month}$	15
	$-Q_{month}$	15	$-Q_{month}$	15	$-Q_{month}$	15	$-Q_{month}$	15	$-Q_{month}$	15
	$+W_{day}$	36*	$+W_{day}$	36*	$+W_{day}$	36*	$+W_{day}$	36*	$+W_{day}$	36*
	$-W_{day}$	36*	$-W_{day}$	36*	$-W_{day}$	36*	$-W_{day}$	36*	$-W_{day}$	36*
	$+Q_{day}$	36*	$+Q_{day}$	36*	$+Q_{day}$	36*	$+Q_{day}$	36*	$+Q_{day}$	36*
	$-Q_{day}$	36*	$-Q_{day}$	36*	$-Q_{day}$	36*	$-Q_{day}$	36*	$-Q_{day}$	36*
	W_{tm}	2	W_{tm}	2	W_{tm}	2	W_{tm}	2	W_{tm}	2
Power	+p (15, 30, 60) / 3360									
	-p (15, 30, 60) / 3360									
	+q (15, 30, 60) / 3360									
	-q (15, 30, 60) / 3360									
	$+p_{day}$	36*	$+p_{day}$	36*	$+p_{day}$	36*	$+p_{day}$	36*	---	
	$-p_{day}$	36*	$-p_{day}$	36*	$-p_{day}$	36*	$-p_{day}$	36*	---	
	$+q_{day}$	36*	$+q_{day}$	36*	$+q_{day}$	36*	$+q_{day}$	36*	---	
	$-q_{day}$	36*	$-q_{day}$	36*	$-q_{day}$	36*	$-q_{day}$	36*	---	
	$+p_{month}$	15	$+p_{month}$	15	$+p_{month}$	15	$+p_{month}$	15	---	
	$-p_{month}$	15	$-p_{month}$	15	$-p_{month}$	15	$-p_{month}$	15	---	
	$+q_{month}$	15	$+q_{month}$	15	$+q_{month}$	15	$+q_{month}$	15	---	
	$-q_{month}$	15	$-q_{month}$	15	$-q_{month}$	15	$-q_{month}$	15	---	

* - actual day is not included. Its data are stored in the RAM and entered into EEPROM after the day is finished.

4.2. Day Schedule

The tariff change is performed by the module according to the day schedule. Day schedule specify time intervals when one or another specific tariff is active. Up to 16 time intervals can be set in any day schedule. Up to 4 tariff activity time intervals can be set for each tariff. If a certain time interval is not assigned to any tariff zone, energy and maximum demand values are automatically assigned to tariff T4. The day schedule begins at 00:00. An example of day schedule for work days:

Table 7

Day time period	Tariff applied
07 – 08	T2
08 – 11	T1
11 – 18	T2
18 – 20	T1
20 – 23	T2
23 – 07	T4

4.3. Week Schedule

The week schedule specifies which day schedule should be activated certain day. The week schedule recognises each weekday, weekends and public holidays. There can be as many week schedules as tariff seasons.

4.4. Seasons

A year is divided into tariff seasons. A season specifies which week schedule is activated during a certain season. EPQM meter allows setting up to 5 seasons. A season is described by its start and end dates. The seasons are marked with letters A, B, C, D, E and priorities are established. If during the parameterization validity of seasons is specified so that several seasons overlap, during the period of overlap a season marked with a letter closer to the beginning of the alphabet is activated. Days of a year that are not assigned to any season are automatically assigned to E season.

Example: A season is active from 10 01 to 03 31;
B season is active from 05 01 to 08 31;
C season is active from 04 01 to 09 30.

The seasons B and C overlap but season B has a higher priority, therefore season C is active from 04 01 to 05 01 and from 09 01 to 09 30 and B season is active from 05 01 to 08 31.

4.5. Public holiday Calendar

There are two public holiday registers in the meter memory. During meter parameterization, days that shall be marked as public holidays are written into them. Such days are marked as 8th day of a week in the parameterization tables.
There two types of public holidays:

- **Fixed public holidays**. These are public holidays that are celebrated on the same day year after year such as Christmas, state public holidays, etc. They are entered into the fixed public holiday register by specifying month and day.
- **Special public holidays.** These are public holidays celebrated on different day of a month each year. Such public holidays are entered into the shifting public holiday register by specifying year, month, and day.

When a new day begins, the meter addresses to the public holiday registers and checks whether that day is in the public holiday list. If the day is specified in either public holiday list, the tariff module activates day schedule for public holidays (8th day of a week).

4.5.1 Fixed Public holidays

The list of fixed public holidays is specified during meter parameterization and entered into the fixed public holiday register. Such public holidays are celebrated on the same day of a month each year. For an example of a fixed public holiday list, see Table 8.

Table 8

Month	Day	Month	Day	Month	Day	Month	Day
01	1	04		07	6	10	
02	16	05		08	15	11	1
03	1	06		09		12	25, 26

4.5.2 Special Public holidays

It is possible to make a list of special public holidays or special days. Such days are entered into a special days register. Each special public holiday is specified by year, month, and day. The register holds up to 32 special days records. Any day of a present century can be entered into the list.

Note: *day schedules, week schedules, season activity period, and public holidays are specified during meter parameterization..*

5. Data Storage

The storage of measured and calculated values in memory units is organized by CPU. Each second the processor reads the instantaneous values from operative memory unit and calculates average power of the integration period and energy consumption. These calculated values are entered into a separate RAM register. Newly read values are added each second. At the end of the integration period, the demand value is compared to the maximum demands value stored of active tariff. If demand value exceeds the older one, it is entered both into EEPROM integration period register and day maximum demand register. If demand value does not exceed, it is entered into the integration period register only.

The integration period is synchronized with the beginning of a day. It is not possible to change tariff during an integration period, therefore the tariff change cannot abort the integration period. The only way to abort the integration period is the power supply failure. In such case the protection circuit activates, and data calculated during the present integration period are entered into EEPROM unit. Thus data are not lost and the power having been restored, the processor continues calculation according to these data.

6. Data Indication on the Display

EPQM meter allows two modes of accumulated and instantaneous data display:

- Cyclical scrolling mode;
- Manual scrolling mode.

In order to display the main meter data on LCD, HPS is activated by light signals. If HPS does not receive any light signals, the meter switches to the cyclical indication mode after a minute. Light signal (no shorter than 2 seconds) activates menu mode immediately.

Together with parameter value the following data are displayed on LCD: parameter index, abbreviated parameter name and value date mark are shown on the first line; load quadrant, tariff to which reiterated data are assigned and value with exponent are shown on the second line.

The parameter index is a decimal number consisting of two digits X and Y. Their values are described in Table 9.

Table 9

X	Description of X	Y	Description of Y
1	The parameter of active positive energy is shown	1	Average power of integration period is shown P(15, 30, 60); q(15, 30, 60)
2	The parameter of active negative energy is shown	2	Maximum demand of a day P_{day} (q_{day})
3	The parameter of reactive positive energy is shown	3	Maximum demand of a month shown P_{month} (q_{month})
4	The parameter of reactive negative energy is shown	4	Energy consumption of a day is shown W_{day} (Q_{day})
		5	Energy consumption of a month is shown W_{month} (Q_{month})
		6	Total energy is shown W_{tot} (Q_{tot})

Indices of additional meter data also consist of two decimal digits but only their combination is meaningful. The indices of additional parameters are described in Table10.

Table 10

Index	Index description
01	Value calculated according to pulses received by the pulse input
02	Instantaneous value is shown
03	This index describes meter failures
04	This index of parameterization constants

6.1 Cyclical scrolling Indication Mode (CIM)

In this mode, parameters of some data group are indicated on the display one after another within 10 second period. CIM is activated if the control photo sensor does not receive light signal for a minute. In such case data belonging to the parameter group displayed at the moment CIM was activated are displayed in cyclical mode. CIM data sequences are described in Table 11

Table 11

The last selected index or group of parameters	Parameter sequence during CIM
11 … 16 P+ power and energy	Date → 11+P30 → 12+P24h → 13+Pmnt 16+Wtot ← 15+Wmnt ← 14+W24h
21 … 26 P- power and energy	Date → 21-P30 → 22-P24h → 23-Pmnt 26-Wtot ← 25-Wmnt ← 24-W24h
31 … 36 Q+ power and energy	Date → 31+q30 → 32+q24h → 33+qmnt 36+Qtot ← 35+Qmnt ← 34+Q24h
41 … 46 Q- power and energy	Date → 41-q30 → 42-q24h → 43-qmnt 46-Qtot ← 45-Qmnt ← 44-Q24h
Any parameter with the exception of 11 … 46 and the “Instantaneous” group	Date → 16+Wtot (T1...T4) → 26-Wtot (T1...T4) 46-Qtot (T1...T4) ← 36+Qtot (T1...T4)
Parameters from the “Instantaneous” group	Value of chosen parameter are refreshed every second

6.2 Manual Scrolling Mode

Menu mode is used for sequential data review. Menu mode is activated by long light signal from CIM. Data in the menu mode are divided into certain parameter groups (menus).

6.2.1 Additional Labels

When 1 ... 4, 01, 02 parameters are displayed, a (arrow) label is displayed on the left side of the second line. This label indicates load quadrant. The labels and their meanings are specified in Table 12.

Table 12

Label	Label meaning
↗	First quadrant: active +, reactive +
↘	Fourth quadrant: active +, reactive -
↖	Second quadrant: active -, reactive +
↙	Third quadrant: active -, reactive -
◦	No load or very small load
✕	Not all quadrants match; no reactive load.

6.2.2 Main Menu

Main menu includes 8 options. The initial long light signal (>2 sec) stops the cyclical indication and a message **Active + ..** appears on the screen (see Figure 6-1). Options from 2 to 4 and from 01 to 04 (**Active -** , **Reactive +**, **Reactive -, Wtm, Instantaneous, Failures, Parameters**) can be called in a sequence by short light signals (<0,5 sec). After the desired option is chosen, it can be called by long light signal. In the Figures below, thin arrow means short light signal (<0,5 sec) and bold outlined or dash line – long light signal (>2 sec). Two dots at the menu name mean that this menu has its own submenus which can be called by long light signal.

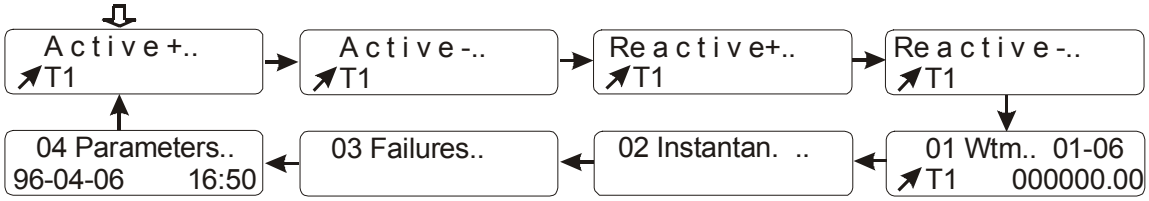


Figure 6-1. The main menu

6.2.3 "Active +"," Active -"," Reactive +","Reactive -" Menus

All these options are the same. A desired parameter (11-16 ... 41-46) can be called short light signal. Detailed data on the selected parameter group can be selected by long light signal. After the option is selected an arrow appears instead of two dots.

Further on, the power values of various tariff zones or integration periods with the same date can be selected by short light signals; indication date can be changed by long signals. Once the message **END** is displayed, a short signal brings back to the beginning of the review and long signal calls the next main menu option. The possible review sequences of menus are shown in Figure 6-2. The data displayed in those menus and their coverage is described in Table 6.

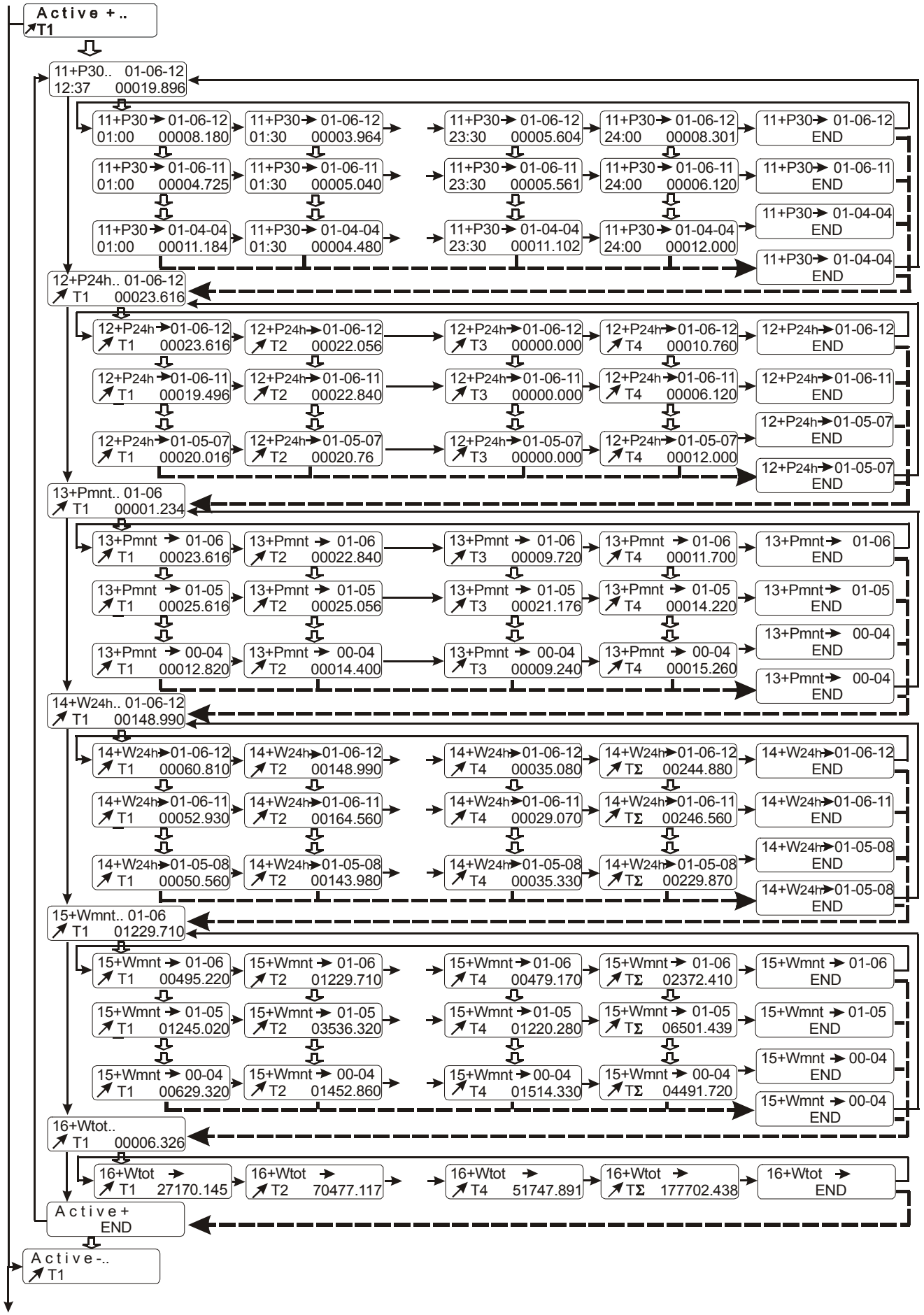


Figure 6-2. The "Active +.." menu

6.2.4 "Wtm.." Menu

Values of present and last months calculated according to pulses received from pulse input are shown in this menu. The possible data review sequences are shown in Figure 6-3.

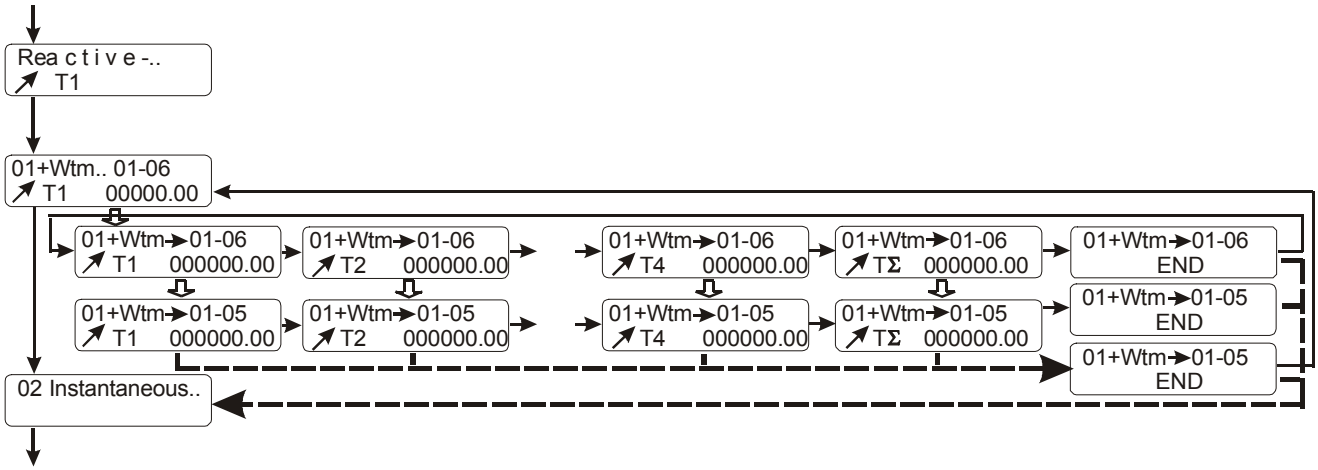


Figure 6-3. Telemetry data menu "W_{tm}.."

Detailed data are called by long light signal. Values of the present month in various tariff zones are called by short light signals. Values of the last month are selected by long light signal. After all the data of a certain month are reviewed, the message **END** appears. Short light signal brings back to the menu start point; long light signal brings to "Instantaneous" menu.

6.2.5 "Instantan. .." Menu

Index of this menu data is 02. Instantaneous value of any parameter specified in Table 13 can be displayed. The values on the display are refreshed every second.

Table13

Parameter group	Parameter name	Index	Label	Comment
Instantaneous	Active power	02	P-L1	Power of each phase (L1, L2, L3) and total power (Σ)
	Reactive power		Q-L1	
	Total power		S-L1	
	Voltage		U-L1	Voltage of each phase (L1...L3)
	Current		I-L1	Current of each phase (L1...L3)
	Power factor		cosφ	Common for all phases
	Network frequency		Frequency	

The values of active and reactive power of separate phases are displayed as signed number, their sum is calculated and displayed with the signs of additives taken into account; the total summary power is calculated as the sum of total power of all phases.
The possible data review sequences for this menu are shown in Figure 6-4.

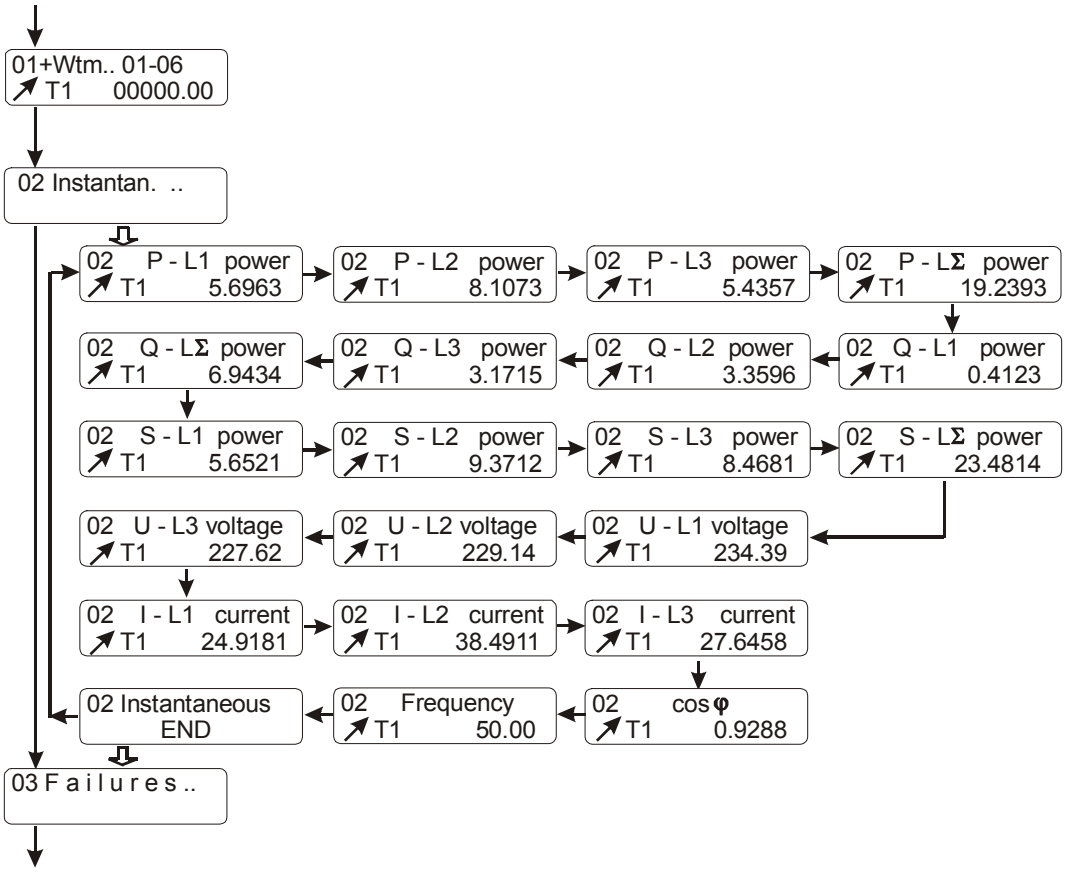


Figure 6-4. The "Instantaneous.." menu

6.2.6. " Failures.." Menu

The meter records and displays various failures of power supply, clock operation; magnetic field influences, etc. All information on those failures is stored in the meter and can be reviewed in the "**Failures..**" menu**.**

Table 14 lists all data displayed in this menu. The possible data review sequences for the "Failures.." menu are shown in Figure 6-5.

Table 14

Parameter group	Parameter name	Index	Label	Comment
Failures	Power supply failure	03	MD	The number of power failures, the date ant time of last 10 disconnections.
	Phase number changes		FP	The number of changes, the date and time of last 5 changes.
	Other failures		Other	The number of meter failures.
	Clock failures		Clock	The number of clock failures.
	Magnetic field influences		MF	The number of influences, total duration, date and time of the last influence.

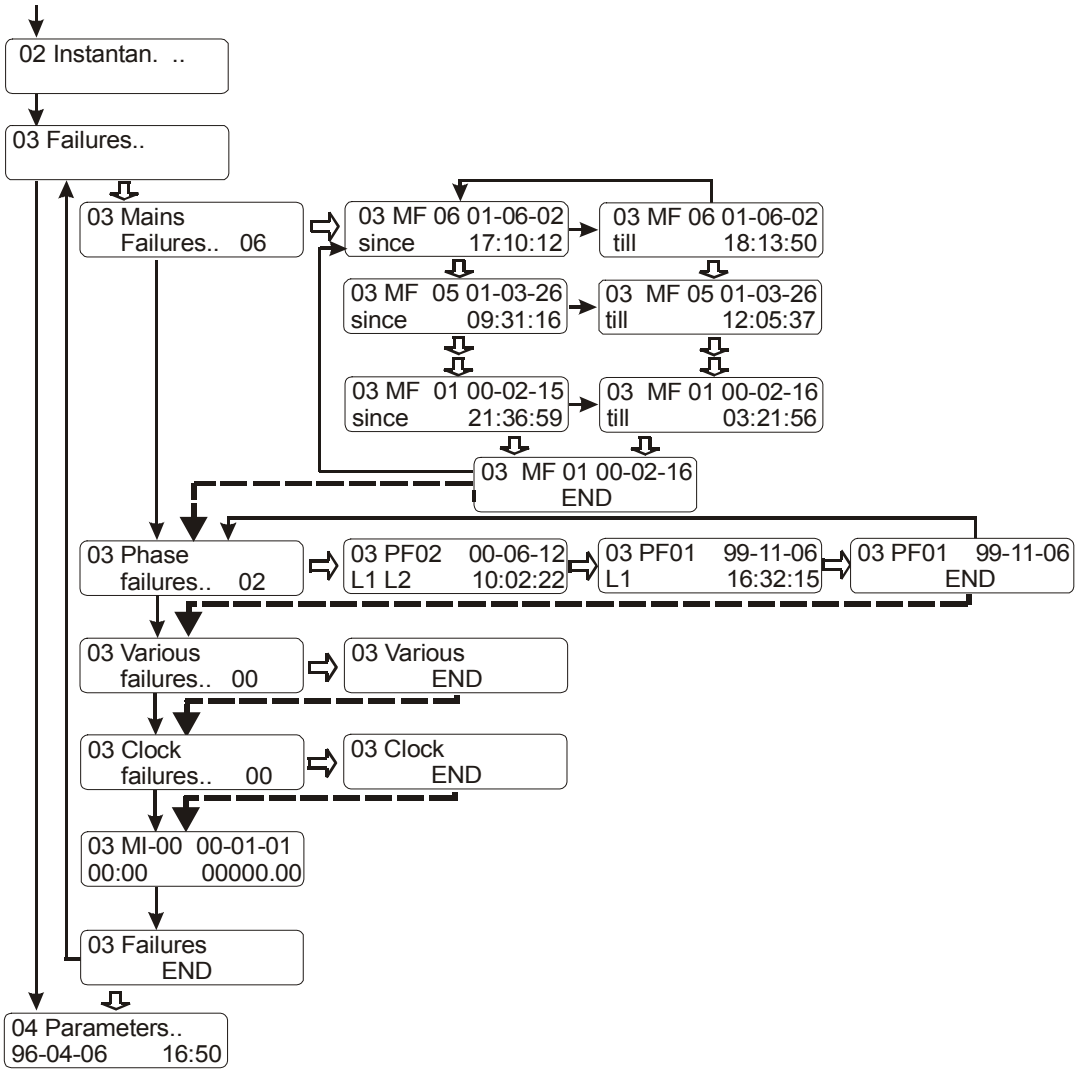
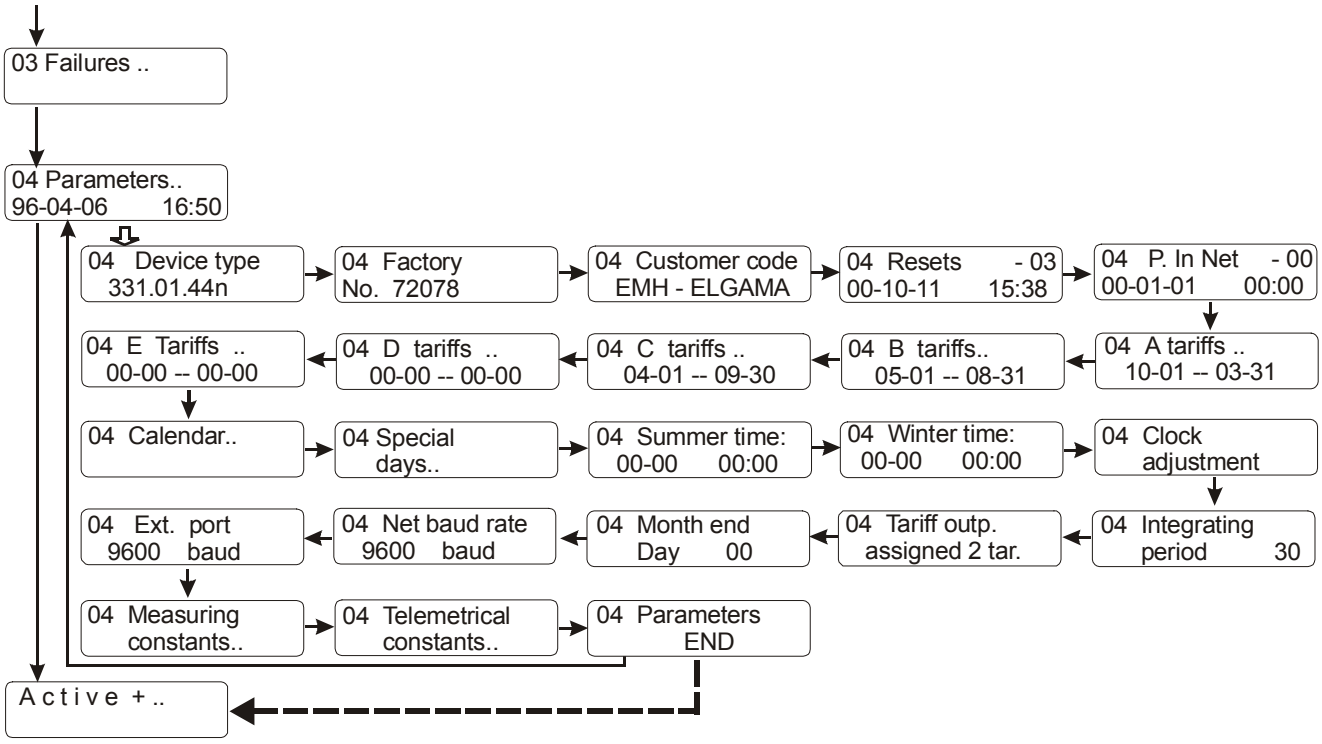


Figure 6-5. The "Failures.." menu

6.2.7 "Parameters.." Menu

All constants, parameters and settings of EPQM meter can be displayed in this menu. All these parameters are entered during meter parameterization. Possible sequences of the review are shown in Figure 6-6.

Some of these options contain submenus. Names of these options are followed by two dots.



Page 6-6. The "Parameters.." menu

6.2.7.1 "A Tariffs.." – "E Tariffs.." Menus

Parameters of the tariff seasons A-E can be reviewed in the menus **A tariffs**-**E tariffs** displays. The beginning ant the end dates of season activity are shown in the second LCD line. The descriptions of tariffs 1 to 4 (At1- At4) can be called by long light signals. Up to 4 daytime intervals can be set for each tariff. These intervals can be called by short light signals. The detailed sequences of these menus review are shown in Figure 6-7.

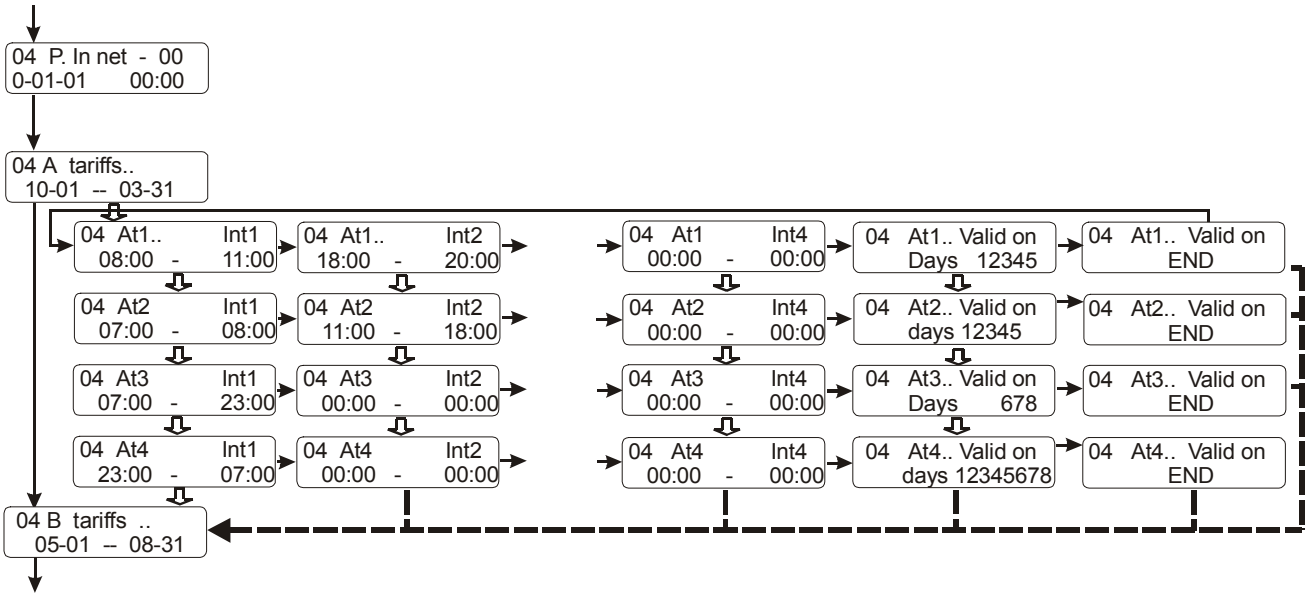


Figure 6-7. The "A Tariffs.." menu

6.2.7.2 "Calendar.." Menu

Public holidays specified during meter parameterization can be displayed in this menu. The day review sequences are shown in Figure 6-8.

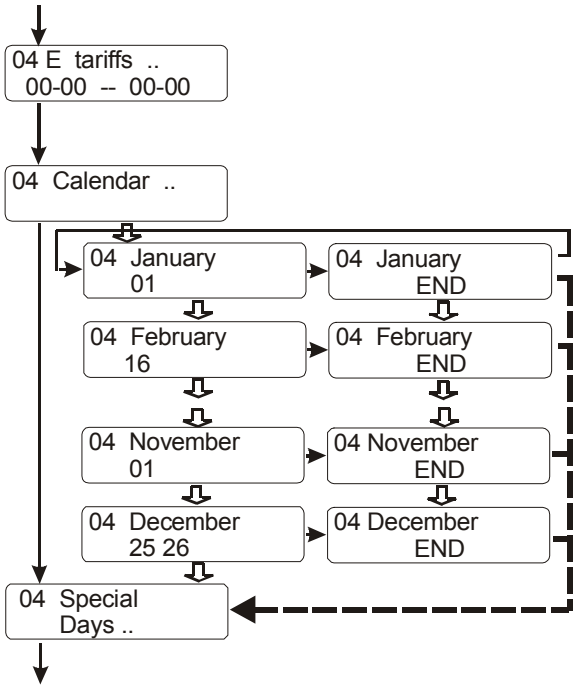


Figure 6-8. The"Calendar.." menu

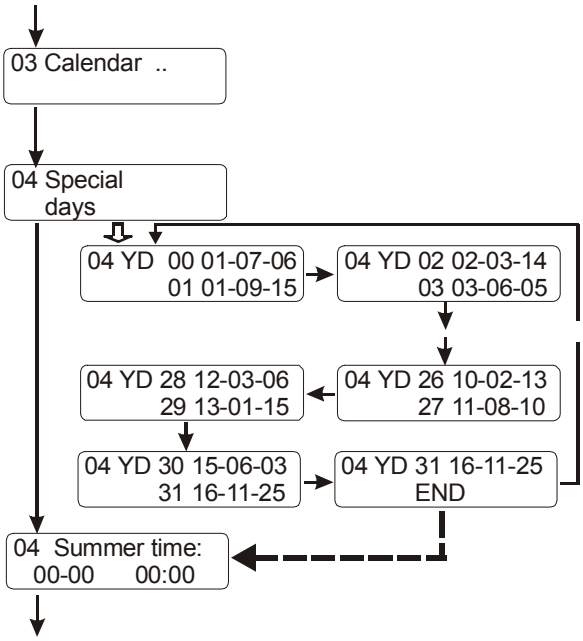


Figure 6-9. "Special Days.." menu

6.2.7.3 "Special Days.." Menu

Special public holidays (see Chapter 4.5.2) specified during meter parameterization can be displayed in this menu. The data review sequences are shown in Figure 6-9.

6.2.7.4 "Measurement Constants.." Menu

Meter measurement constants such as transformation or calibration coefficients can be displayed in this menu. The possible data review sequences are shown in Figure 6-10.

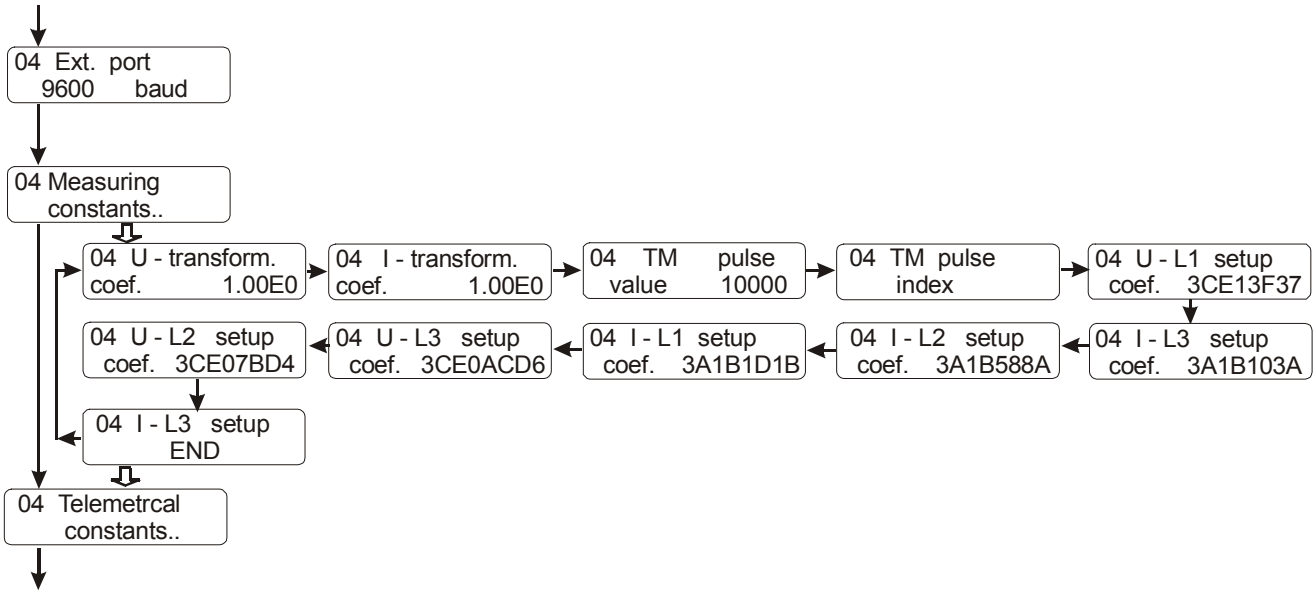


Figure 6-10. The "Measurement Constants.." menu

6.2.7.5. "Telemetric Constants.." Menu

Meter pulse outputs and inputs such as pulse input and outputs' constants specified during meter parameterization can be displayed in this menu. The possible data review sequences are shown in Figure 6-11.

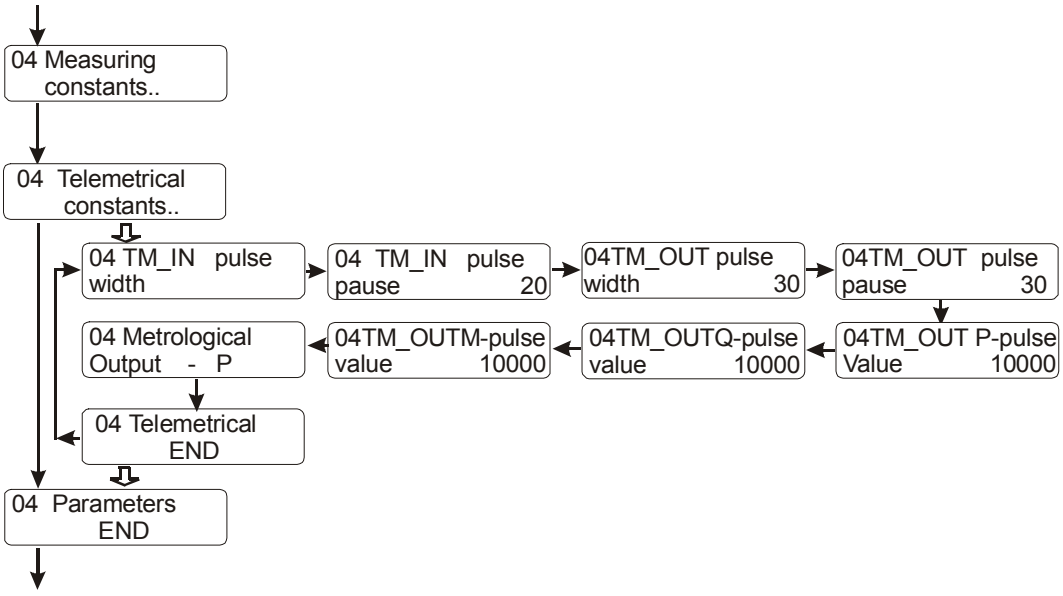


Figure 6-11. The "Telemetry Constants.." menu

6.3 Data Display When the Meter is Powered by the optional External Backup Power Supply

When the network voltage is off, the data can be displayed on the screen if the External Backup power supply is connected. The following data can be displayed:

- Demand (+P, -P, +q, -q): values of integration periods of the last 35 (70 or 140 when the duration of the integration period is respectively 30 or 60 min.) days (including the present);
- The maximum demand of a day of the last 37 days for each tariff time zone (+P, -P, +q, -q);
- The maximum demand of a month of the last 15 months for each tariff time zone (+P, -P, +q, -q) [1];
- The energy consumption of a day for each tariff time zone and total consumption of all tariff time zones for each kind of energy of the last 35 days (+W, -W, +Q, -Q);
- The energy consumption of a month for each tariff time zone and total consumption of all tariff time zones for each kind of energy of the last 15 months[1] (+W, -W, +Q, -Q);
- The total energy for each tariff time zone and total energy of all tariff time zones for each kind of energy (+A, -A, +R, -R);
- The meter failures: power failures[2], phase number changes, clock failures ant other kind of failures, the number of external magnetic field influences, total duration, the date and time of the last influence;
- The meter parameters.

[1]-The present day (month) data are discarded.

[2]- When data are displayed while the meter is disconnected from the electrical network, 85-02-21 will be always displayed instead of the date of the last voltage restoration; the displayed time will be the same as that of before-the-last restoration of voltage.

Note*: While the meter is powered by the external backup power, a sign □ is displayed instead of a quadrant mark (arrow).*

7. Communication

The meter can be connected to a personal computer or a portable data exchange terminal via optical or current loop communication interface therefore enabling data exchange between the meter and the computer.

Communication – bi-directional data exchange between meter and a personal computer or portable data reading terminal according to the certain communication protocol.

During the communication procedure, it is possible to:

- download accumulated data and the meter parameters from the meter to a computer or data terminal;
- perform meter parameterization (PC or HHU with special software is required in both cases).

If there is IEC 62056-21 communication protocol protection system installed in the meter, the protection must be deactivated before the communication starts (see Chapter 9.2.2.).

7.1. Data Transfer via Optical Interface (D0)

The purpose of this interface is to ensure a local data transfer to a portable computer or data terminal and meter parameterization. The following data can be transmitted:

- Demand of active and reactive energy of both directions (+P, -P, +q, -q);
- All maximum demands of a day of active and reactive energy of both directions for each tariff time zone ($+P_{day}$, $-P_{day}$, $+q_{day}$, $-q_{day}$);
- All maximum demands of a month of active and reactive energy of both directions for each tariff time zone ($+P_{month}$, $-P_{month}$, $+q_{month}$, $-q_{month}$);
- All values of month consumption of active and reactive energy of both directions for each tariff time zone ($+W_{month}$, $-W_{month}$, $+Q_{month}$, $-Q_{month}$) and the total consumption of each kind of energy;
- Total consumption of positive active energy +A for each tariff time zone and total consumption of all tariffs;
- Total consumption of positive active energy -A for each tariff time zone and total consumption of all tariffs;
- Total consumption of reactive energy +R for each tariff time zone and total consumption of all tariffs;
- Total consumption of reactive energy -R for each tariff time zone and total consumption of all tariffs;
- Values of present and last months calculated according pulses received from pulse input ;
- Failure data;
- The meter parameters and constants;
- Energy consumption during the present and last integration period;
- Instantaneous values of apparent active and reactive power, voltage and current of each phase, power factor cos (φ) and network frequency.

7.2 Data Transfer via Current Loop Interface CL1

The following data can be transferred via current loop interface:

- Date/time + status word + integration period duration flag + meter connection (three/four wires) flag;
- All demand values (+P(15, 30, 60)) of active positive energy: exponent and value;
- All demand values (-P(15, 30, 60)) of active negative energy: exponent and value;
- All demand values (+q(15, 30, 60)) of reactive positive energy: exponent and value;
- All demand values (-q(15, 30, 60)) of reactive negative energy: exponent and value;
- All day consumption values of active and reactive energy of both directions during 24-hour for each tariff time zone (T1…T4): exponent and value;
- All month consumption values of active and reactive energy of both directions during a month for each tariff time zone (T1…T4): exponent and value;
- Energy consumption: Total active positive and negative; total reactive positive and negative for each tariff time zone and total consumption for each energy kind since the factory parameterization: exponent and value;
- Values of the present and last month calculated according to pulses received from pulse input for each tariff ;
- Instantaneous values (P1, P2, P3, Q1, Q2, Q3, U1, U2, U3, I1, I2, I3, frequency, quadrant);
- Voltage failure array: data on the last 10 voltage failures – date and time of failure beginning and end;
- Data on the last 10 phase number changes: date and time of the failure and flag of the failed phase;
- The number of additional magnetic field influences, date and time of the last influence and the total duration ;
- Values demands of the present and last integration period (+P, -P, +q, -q): exponent and value;
- Maintenance information: the number of parameterizations, date and time of the last parameterization; date and time of start-up; current date and time;
- The meter parameters.

7.3 Data Transfer via optional Current Loop Interface CL2

The following data can be transferred via optional current loop interface:

- Date/time + status word + integration period duration flag + meter connection (three/four wires) flag;
- Instantaneous values (P1, P2, P3, Q1, Q2, Q3, U1, U2, U3, I1, I2, I3, frequency, quadrant).

Note: *data transmission protocols and baud rates are described in chapter "Communication Interfaces" (see Chapter 2.3).*

7.4 Data Transfer While the Meter is Powered by the optional External Backup Power Supply

If the main power supply is disconnected the data can still be transferred via optical or current loop (CL1) interface provided the external backup power supply is connected. The following data can be transferred via both interfaces:

- All demand values stored in the memory (+P, -P, +q, -q);
- All day maximum demand for each tariff time zone (+P, -P, +q, -q);
- All month maximum demands for each tariff time zone (+P, -P, +q, -q);
- All day energy consumption during 24-hour for each tariff time zone and total values for each kind of energy stored in the memory (+W, -W, +Q, -Q);
- All month energy consumption during a month for each tariff time zone and total values for each kind of energy stored in the memory (+W, -W, +Q, -Q);
- Total accumulated energy consumption for each tariff time zone and total values for each kind of energy (+A, -A, +R, -R);
- The meter failures (power failures, phase number changes, clock failures, external magnetic field influences);
- The meter parameters.

Notes:

- *The integration periods with no network voltage are assigned to zero values;*
- *If the meter has not been connected to the network voltage for the last 12 months all month values are equal to zero;*
- *While the meter is disconnected from the electrical network, 85-02-21 will be always displayed instead of the date of the last voltage restoration; displayed time will be the same as that of one-but-last voltage restoration.*

8. Parameterization and Data Deleting

The meter can be parameterized via optical or current loop CL1 (upon request) interfaces. ELGAMA - ELEKTRONIKA software must be used for parameterization. Table 15 lists the constants that can be entered into the meter during parameterization. Date and time of the last 10 parameterizations, current and voltage transformation factor product and the group (code) of edited parameterization constants are stored in the memory. In dependence of the group of edited parameterization constants, the following data is to be deleted from the memory: stored demand values P15 (30, 60); day maximum demand P_{day} and month maximum demand P_{month}; day energy consumption W_{day} and month energy consumption W_{month} (see Table 15). The parameterization is enabled only after entering correct password. If incorrect password has been entered 4 times in turn in a day, the connection interface is locked and no password whether correct or not is accepted for the further 24 hours. The message “Bad password-4” will appear trying to connect with the meter during the lockout period.
The parameterization course is described in ELGAMA - ELEKTRONIKA software manual.
If the communication protection system is active, the communication interface protection must be deactivated before the parameterization (see Chapter 9.2.2.).

Only a authorized person from the organization that installed the meter may carry out the parameterization and register all parameter changes of all meters in the meter parameterization log (for the example see Appendix C). In all other cases parameterization shall be interpreted as tampering.

Table 15

Group (code)	Name of constant	P15 (30,60)	Pday, Pmonth	Wday, Wmonth
A (01h)	Customer code Time correction Tariff output flag Test output TM flag Current loop interface baud rate * Password	Non-erasable	Non-erasable	Non-erasable
B (02h)	Public holiday calendar Dates of season changes Tariff tables for A, B, C, D, E seasons Summer/Winter time start date and hour Last day of the billing period	Non-erasable	Non-erasable	Non-erasable
C (04h)	TM IN factor TM IN input weight TM IN pulse length and pause	Non-erasable	Non-erasable	Non-erasable
D (08h)	Pulse output TM coefficient +P,- P TM output coefficient +Q, -Q TM output coefficient TM OUT pulse duration and pause	Non-erasable	Non-erasable	Non-erasable
E (10h)	Integration period	Erasable	Erasable	Non-erasable
F (20h)	Date/Time	Non-erasable	Non-erasable	Non-erasable
G (40h)	Voltage transformation coefficient with exponent ** Current transformation coefficient with exponent **	Erasable	Erasable	Erasable if exponent is changed
H (80h)	Erasure command	Erasable	Erasable	Erasable
Factory constants	Device type Factory number Customer code Voltage calibration factors Current calibration factors	-	-	-

* - The constant is entered via optical interface only.

9. Meter Data Protection

EPQM meter has several step protection from unauthorized actions:

- Physical protection;
- Software protection of data and parameters.

9.1 Physical Protection of Data and Parameters

The meter is protected against unauthorized access by the following physical measures:

- Sealed front cover;
- Sealed terminal block.

The sealed front cover moulded from transparent plastic restricts the access to the initialization button located under the front panel. Pressing this button enables to change factory constants. The transparent plastic cover is fixed by two sealed screws.
The terminal block is sealed after the meter is installed at the user premises. The sealing is performed by a authorized person from the organization that installed the meter.

9.2 Software Protection

The meter has software measures of data protection and the device recording the parameter changes and attempts to affect the accuracy of calculations (event log).

9.2.1 Password

Each time the connection is established via communication interface, the meter requires the password. The password consists of any 8 ASC II symbols. No parameters can be changed until the correct password is entered. If incorrect password is entered 4 times in turn during a day, communication interfaces will be locked for 24 hours. During that period parameterization is impossible.

9.2.2. Communication Protection

EPQM meter has optional communication protocol IEC 62056-21 protection system that restricts the connection with a computer or portable data terminal until the photo sensor located beside the optical interface has received light signal with duration of 1 second. After receiving a signal, the protection system is deactivated for a hour. If connection is attempted without deactivating the protection, a message "*Serial comm. protected!!!*" appears. The protection system is automatically activated upon the failure of network voltage. After voltage restoration, light signal must be applied again.

Note: *the communication protection system is not a part of standard equipment. It must be ordered separately.*

9.2.3 Event Log

The event log is an EEPROM area that stores the following data:

- Network voltage failures;
- Phase number changes;
- Data on external magnetic field influences ;
- Initialization data;
- Data on the last 10 parameterizations;
- Data on the internal clock failures;
- Data on the meter operation failures.

This information can be displayed on the screen or transmitted via communication interfaces.
Each time the data is read they are compared to the data read the last time and thus unauthorized access attempts (if any) are discovered.

10. Transportation and Installation

10.1. The Completeness

The meter is supplied to the customer as indicated in Table 16 below.

Table 16

Name	Quantity
The Multitariff EPQM meter of active and reactive electrical energy	1
Datasheet	1
[1] User Manual	1
[2]User Manual of Meter Parameterization and Data Readout	Upon contract

Notes:
[1] *A single copy of User Manual can be delivered with a batch of meters upon an agreement.*
[2] *Delivered only to authorized organizations installing and operating EPQM meters according to the contracts concluded with the manufacturer or its representatives*.

10.2. General Requirements and Installation Procedure

Installation, uninstallation, calibration and parameterization of the meter can be performed only by the authorized persons with relevant qualifications.

The new parameterization settings has to be done if factory-presets are not in conformity with the local regulations rules. Customer identification code, password, date and time could be set when procedure describes above completed. The details of parameterization settings are described in Meter User Manual and software LZPEMS User's Manual.

Meter operation failure if sign ***"Error"*** appears on LCD. The meter must be disconnected and sent for repair in that case. Failure codes could be identified via optical connection interface using LZPEMS software.

Positions of mounting holes are presented in **Figure 10-1**

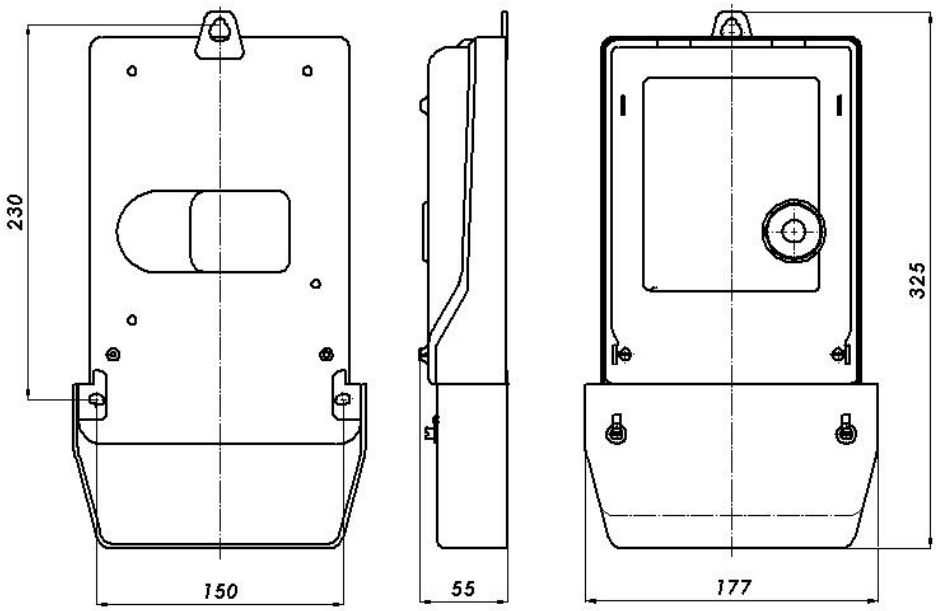


Figure10-1. The overall dimensions and mounting holes

Connection diagrams are presented in **Figures 10-2.4; 10-3.4** and **10-4.3**. For installation of a separate meter, see its datasheet.

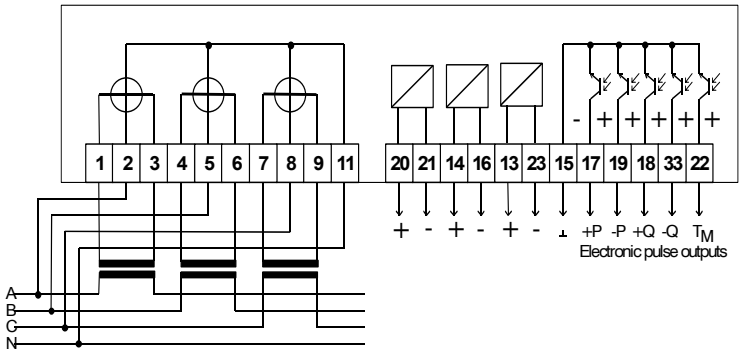


Figure 10-2. 4-wire meter connection via current transformers

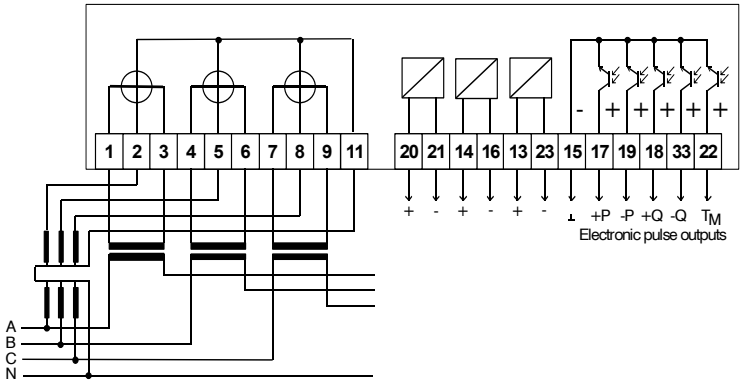


Figure 10-3. 4-wire meter connection via current and voltage transformers

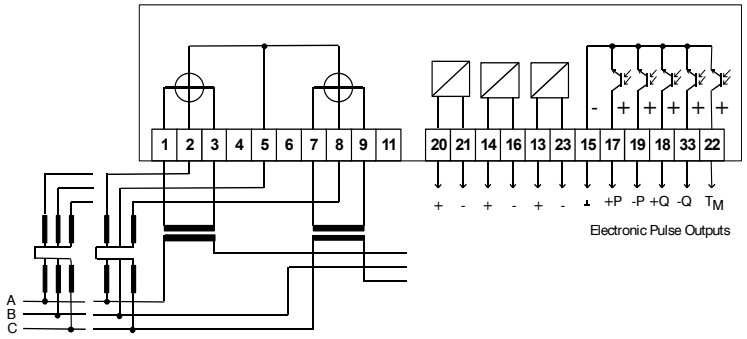


Figure 10-4. 3-wire meter connection via current and voltage transformers

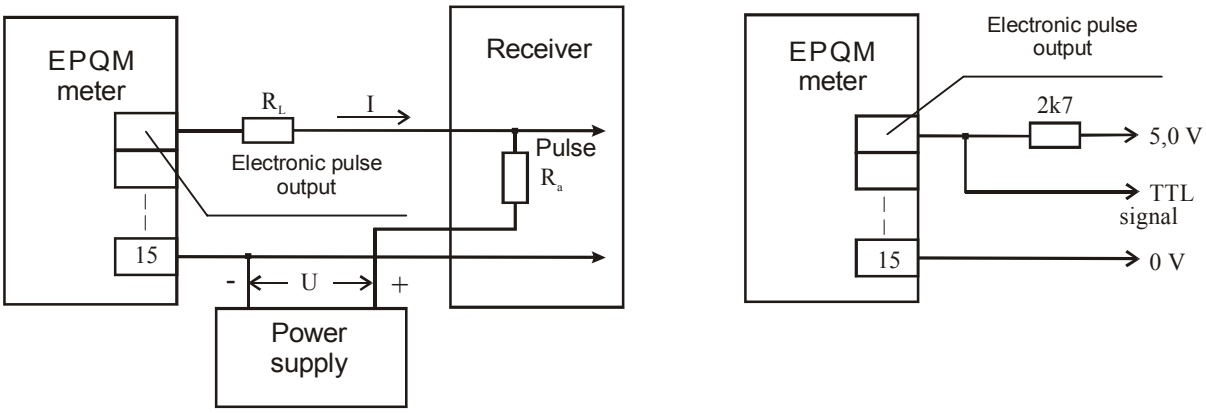


Figure 10-5. Connection of external devices to the electronic test/pulse outputs T_m, +P, -P, +Q, -Q

U – not exceeding 24.0 V, I – not exceeding 30.0 mA

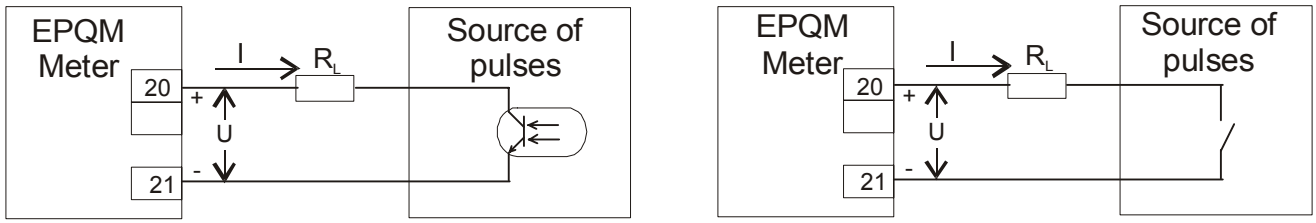


Figure 10-6. Connection of an external device to the pulse input

R_L- communication line impedance (0÷1,2 kΩ), U – output voltage (12V ± 20%), I - current

- The recommended connections of external devices to the electronic pulse outputs (T_M, +P, -P, +Q, -Q) are shown in Figure10-5.
- The current from the external device is fed into the current loop interface. The current loop circuit current is equal to 20 mA, maximum permissible voltage 27 V.
- The recommended connection to the telemetry input are shown in Figure 10-6.
- Regular calibration of the meter is recommended once in 8 years.
- The meter can be repaired only by natural or legal persons authorized by the manufacturer.

10.3. Start-up

10.3.1. After the meter power supply is on, a message ***Power-on Reset.. Initialization passed*** is displayed briefly (about 1 second). Then the following data is displayed: date, time, active tariff, quadrant, winter/summer time flag, season flag.

10.3.2. The power supplier representative commissioning the meter shall perform the following actions:

- check whether the factory parameterization data correspond to the meter operating conditions (the factory parameterization data are specified in Appendix C);
- fill in the parameterization data table on the meter datasheet;
- sign the meter commission certificate enclosed with the meter datasheet.

10.3.3. If the factory parameterization data does not correspond to the operating conditions (different tariff time zones, transformation factor, telemetric constants, telemetric pulse parameters), the meter parameterization procedure must be performed (see Chapter 10.3.5).

10.3.4. If the factory parameterization data correspond to the operating conditions, it is sufficient to write in the customer code, password and start-up date and time.

10.3.5. The order of parameterization:

- Fill in the parameter template on a personal computer (for more information on PC operation and parameterization data preparation, see relevant separate manuals).
- Ensure that the PC displays proper date and time. Correct if necessary.
- Place the optical head against the meter optical interface and connect its socket into the PC's COM1 or COM2 port (see Figure 10-7).
- If the meter has been in use, download the accumulated data.
- Enter new parameterization data according to the operating conditions.
- Enter date and time.
- Ensure that the entered parameterization data is correct (See Figure 6-6., "Parameterization.." menu).

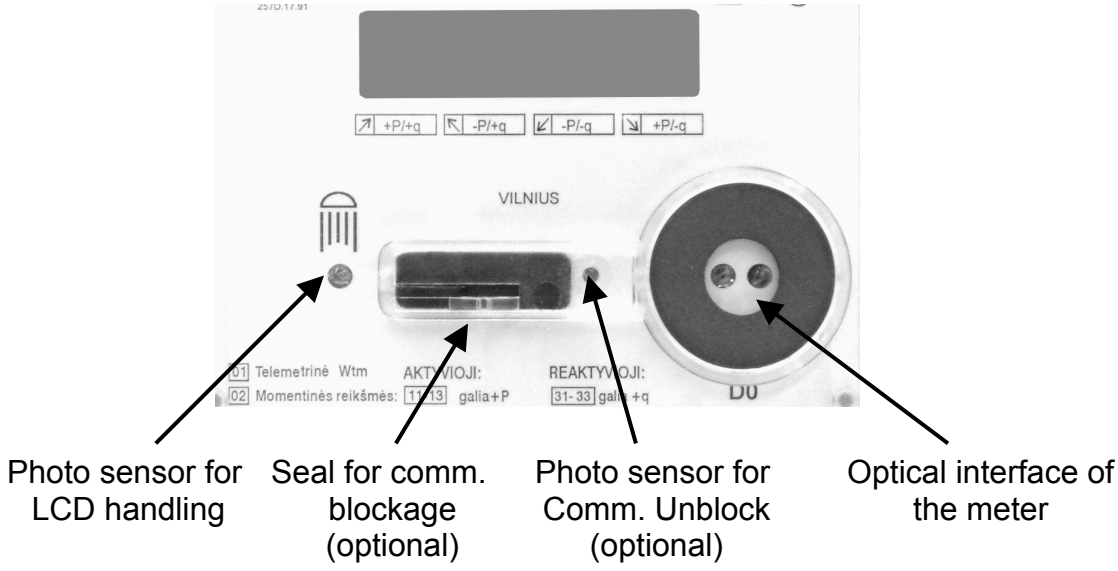


Figure 10-7. Location of the control photo sensor and the optical interface connection on the meter panel.

10.5. Transportation and Storage

10.5.1. Before the installation the meter must be stored indoors in delivery or transportation package. The permissible temperature range is from 5°C to 40°C, the maximum permissible relative humidity 80% at 25°C. No aggressive gas or vapour is permissible in the storage premises.

10.5.2. On shelves or racks, the packaged meters can be stored in stacks of no more than 5 packages in height at the minimum distance of 0.5 m from heating appliances.

10.5.3. Unpacked meters can be stored in the repair shop only. They can be stacked no more than 5 devices in height with inserts to separate them. The permissible temperature range is from 10°C to 35°C, the maximum permissible relative humidity 80% at 25°C.

10.5.4. In the winter time, the package must be left in a heated room for at least 6 hours before opening.

10.5.5. The meters must be only transported in closed environments such as carriages, containers, cars, or cargo holds. The maximum permissible shock acceleration is 30 m/s^2, from 80 to 120 shock per minute. The permissible temperature range is from -50°C to +50°C, the maximum permissible relative humidity 98% at 35°C.

10.6. Warranty Terms

"ELGAMA ELEKTRONIKA" warrants each electricity meter it manufactures to be free from defects in material and workmanship under normal use and service specified in operation manual for a period of 18 months from date of shipment from factory.

In the event of a failure covered by warranty, "ELGAMA ELEKTRONIKA" will undertake to repair or replace the meter providing warrantor determined that it is defective and it is returned with all transportation charges prepaid to an authorized center or the factory accompanied with this Certificate. Repairs or replacement under warranty will be made without charge.

Warranty shall not apply to any meter, which has been subject to misuse, negligence, accident, lightning, incorrect installation, or neither use not in accordance with instructions nor any unit that has been altered outside "ELGAMA ELEKTRONIKA" authorized factory workshop.

"ELGAMA ELEKTRONIKA" is not liable for special, indirect or consequential damages or loss of profit or for expenses sustained as result of a meter malfunction, incorrect application or adjustment.

11. Failure Reports

11.1. Error Reports

Table 17

Warning	Possible reasons	Measures
Bad constants	Incorrect parameterization of damaged meter	Carry out the parameterization. If the warning still appears replace the meter
T!!!	The meter operates as a single tariff device recording total energy	Set data and time and other parameters if necessary with the help of PC
!!! Time???	Clock failure	Set data and time
Bad battery	Low lithium battery voltage	Replace the battery
Bad password -4	4 parameterization attempts using wrong password in 24 hours	The interface will be automatically unlocked after 24 hours
Serial comm. protected!!!	Interface protection system still active	Light the unblocking photo sensor for 1 second using a flashlight

11.2. Other Failures

Table 18

Warning	Possible reasons	Measures
The pulse LED indicator flashes when there is no load	Damaged meter	Replace the meter
The meter records too big/small demand	Wrong connection Internal failure	Check the connections Replace the meter
No messages on the screen	Power supply failure Damaged screen	Check power circuits Replace the meter

During the meter malfunction, the failure code is stored in event log and can be reviewed in menu option "**Other failures"**. This is maintenance information menu. After discovering records in this menu please contact the manufacturer or its authorized representative.

Appendix A

EPQM Meter Designation for Ordering

Meter Type EPQM - X X X. X X - XXX

Connection:

3 – 3-element 4-wire connection
4 - 2-element 3-wire connection

Nominal Voltage:

1 – (3 x 57,7/100) V; (3 x 63.5/110) V; (3x69,2/120) V
(3 x100) V; (3 x 110) V; (3 x 120) V;

3 – (3 x 220/380) V; (3 x 230/400) V; (3 x 380) V; (3 x 400) V;
4 – (3 x 127/220) V; (3 x 120/208) V; (3 x 220) V; (3 x 230) V;

Nominal Current:

1 - 5 A (transformer connection);
2 - 1 A (transformer connection)

Software Version:

01 – Software in Lithuanian
02 - Software in Russian
03 - Software in English
04 - Software in Spanish
05 - Software in Latvian

Purpose of Auxiliary Outputs:

on terminals 14-16
on terminals 13-23
on terminals 20-21

1	Relay
2	Electronic pulse input S0
3	External backup power supply terminals
4	Current loop II (instantaneous data)
5	Current loop I (commercial data)
6	RS 485
7	M-BUS

Appendix B

Technical specifications

The meter resistance to environmental and mechanical effects complies with the requirements of IEC 62053-22, IEC 62053-21 Standards. The main technical specifications are specified in Table B-1.

Table B-1

Precision Class	0.5s (IEC 62053-22)	1.0 (IEC 62053-21)	2.0 (IEC 62053-23)
Threshold sensitivity, %I_{nom}	0.1	0.2	0.3
Nominal current (I_{nom})	5A or 1A		
Maximum current %I_{nom}	200%		
Nominal voltage, (U_{nom}), V	3x57,7/100; 3x63,5/110; 3x69,2/120; 3x220/380; 3x230/400; 3x380; 3x400; 3x127/220; 3x120/208; 3x220; 3x230		
Permissible voltage range	-20% +15% of U_{nom}		
Power consumption: **voltage circuits** **current circuit**	 No more than 1.5VA (1W)/phase No more than 0.3 VA/phase		
Accuracy of the internal clock	≤ ±0,5s/24h at 23°C ≤ ±0,1s/24h at 1°C		
Network frequency	50Hz or 60Hz		
Installation location	Closed premises free from dust and chemically active gas or vapor		
Operating temperature Not applicable to LCD	from -20 °C to +55°C from -25 °C to +55°C		
Atmospheric pressure	from 84 to106.7kPa (630 - 800mm Hg),		
Relative humidity	up to 90% (t=30 ^{o}C)		
Protection class	2		
Dimensions, mm	325x177x55		
Weight	No more than1,6kg		

Additional conversion error obtained by converting no less than 1000 pulses received via electronic pulse input to named values – 0.05%. The maximum permissible additional measurement error while measuring the demand (or maximum demand) within the normalized load range - ±0.1%

Appendix C

The Example of Parameterization Data

Software version	
Meter type	
Serial No.	
User code	
Number of data resets via optical interface	
Number of data resets via current loop interface	

Integration period	
End of billing period.	
Baud rate in the network	
Relay-activating tariff	

Tariffs

Tariff zone	Designation, the beginning and the end of seasons (month, day)									
	A From to		**B** From to		**C** From to		**D** From to		**E** From to	
	from-to (h)	days of week	from - to (h)	days of week	from - to (h)	days of week	from - to (h)	days of week	from - iki (h)	days of week
T1										
T2										
T3										
T4										

Day time intervals not included in the table are assigned to the **T4** tariff by default.
Year days not assigned to any season are assigned to the **E** season by default.
The season priorities: **A** – the highest, **E** – the lowest.

Public holidays

Month	Day	Month	Day	Month	Day	Month	Day
01		04		07		10	
02		05		08		11	
03		06		09		12	

Special public holidays

Year	Month	Day	Year	Month	Day	Year	Month	Day	Year	Month	Day

Daylight saving changes	Date and time of correction			
	Month	Day	Hour	Minute
Winter/summer				
Summer/winter				
Clock correction (from - 5 s to +5 s daily)				

Measurement coefficients

Voltage transformation coefficients	from 1,00E0 to 9,99E9	
Current transformation coefficients	from 1,00E0 to 9,99E9	
TM IN pulse value	from 1 to 65530	
TM IN pulse exponent	from 0 to 9	
***Note**: the product of mantissas of voltage and current transformation coefficients must be no bigger than 100*		

Telemetry constants

TM IN pulse duration, ms	from 10 to 250	
TM IN pulse pause, ms	from 10 to 250	
TM OUT pulse duration, ms	from 10 to 250	
TM OUT pulse pause, ms	from 10 to 250	
TM OUT P-pulse value, pulse/kWh	from 1 to 65530	
TM OUT Q- pulse value, pulse/kWh	from 1 to 65530	
TM OUT M- pulse value, pulse/kWh	from 1 to 65530	
On the test output (P- or Q-pulses)		

Date of parameterization _____

Parameterization accomplished by: _____

(Signature and stamp of authorized person)